REMARKS

The Applicant has amended claim 1 to clarify the relationship between the control station and the rest of the system, and not in response to the §103 objection. Support for this amendment is found on page 7 (first full paragraph) of the application as originally filed.

Claim Rejections – 35 USC § 103

The applicant has considered the Examiner's objections to the claims, and responds as follows:

The Examiner has rejected claims 1-20 under 35 U.S.C. 103(a) as being unpatentable over US 5,894,450 ("Schmidt *et al.*") in view of Weid *et al.*, "Underwater cableless data transmission", Oceans '93, 'Engineering in Harmony with Ocean', pages 191-193. In particular, the Examiner has stated that Schmidt *et al.* discloses all of the claimed elements of independent claims 1 and 15 except for at least come of the beacons comprising a plurality of light emitting elements whereby when the craft is in the communications zone, it is in optical communication with at least one beacon. According to the Examiner, this missing element is taught by Weid *et al.* and the skilled person would have been motivated to combine these two references.

The Applicant submits that the person skilled in the art would not have arrived directly and without difficulty, by routine steps, at the optical communications system of the subject application in light of the acoustic communications system of Schmidt *et al.* in view of Weid *et al.*, whether taken alone or in combination, for the reasons set out below.

Schmidt *et al.* discloses an underwater mobile array system wherein a number of *autonomous* underwater vehicles (AUVs) in an *array* configuration use acoustic energy to sense oceanographic information, which is then relayed from the AUVs through the network nodes (10, 11, 12, 13, etc.) to the central system (30) using acoustic signals. Each of the AUVs of Schmidt *et al.* must remain in its specific relative position in the array to accomplish the benefits of the system, which appear to be to "permit large aperture sensing and high resolution at a given acoustic or electromagnetic frequency" (column 4, lines 36-38). The only optical communication suggested by Schmidt *et al.* is between AUVs for the purpose of maintaining the relative position of AUVs within the array (column 8, lines 30-62). Such use of optical communication is directional and does not disclose or suggest a solution to the problems associated with the remote

control of submersible crafts for underwater mining, for example, as taught by the subject application (see for example, pages 1-2 of the subject application). Schmidt *et al.* does not teach or suggest the establishment of a communication zone within which uninterrupted two-way communication can occur.

The vehicles of Schmidt *et al.* are autonomous, which by definition means they are not remotely controlled. The concept of a mobile underwater array appears to be the invention of Schmidt *et al.*, and the AUVs of Schmidt *et al.* are always in an array configuration (column 6, lines 43-45). The only vehicles disclosed as having utility in the arrays of the invention are "manned, tethered and/or autonomous underwater vehicles" (column 6, lines 45-49). Schmidt *et al.* does not disclose or suggest the use of remotely operated submersible crafts. Accordingly, Schmidt *et al.* discloses nothing about the use optical communication to transmit *control* data such that a submersible craft can continuously receive a light signal from any direction regardless of orientation of the craft or the position of the craft within a communications zone.

As stated on page 193 (2nd column) of Weid *et al.*, the authors therein disclose an optical cableless data transmission link for data transmission *between fixed points*. For connections between moving stations, such as remotely operated vehicles, Weid *et al.* only states that the optical beam can be made divergent to increase the misalignment tolerance of the system, but this also decreases the ultimate attainable range. The authors state that their system is "bidirectional and uniaxial" and uses a "red laser diode" as an optical source.

Accordingly, Weid *et al.* discloses light emitting elements that emit light as a directional laser beam that is narrow in nature that requires alignment between the light source and the receiver, whether the laser beam is made 'divergent' or not. The person skilled in the art would not be motivated to combine a plurality of the light emitting elements like those described in Weid *et al.* in the manner taught by the subject application, namely on a beacon that emits light in a plurality of directions. A beacon comprising a plurality of the light emitting elements of Weid *et al.* configured to emit light in a plurality of directions would emit only narrow beams creating dark zones between each discrete beam of light emitted. The dark zones would increase in breadth as the distance from the beacon increased. The result would be a communications zone that is not fully illuminated. Such intermittent light coverage means that a submersible craft would not be in

optical communication with at least one beacon at all times within the communications zone, as required by claim 1 of the subject application.

Further, it would require more than a mere workshop improvement for the skilled person to adapt Schmidt *et al.* in view of Weid *et al.* to use optical communication rather than acoustic energy in the system disclosed in Schmidt *et al.* The acoustic energy used in the system of Schmidt *et al.* is, by its nature, omni-directional while the transmission of light signals, on the other hand, is restricted to a 'line of sight'. The disclosures of Schmidt *et al.* and Weid *et al.* do not suggest a solution to the problems associated with maintaining a constant and uninterrupted optical communication link between the source of the control data (*i.e.* a beacon) and a remotely operated submersible craft within a desired communication zone, such that the craft still has the versatility to manoeuvre into any position and any orientation within a communications zone, as required by the underwater mining industry and solved by the subject application.

Schmidt *et al.* states that the mobile array of underwater vehicles has utility in various industries, including oil exploration, military applications, and environmental, oceanographic and biological science. All of these uses relate to oceanographic sampling, surveying or measuring. Schmidt *et al.* is directed to the use of acoustics to survey or sense oceanographic characteristics, which cannot be done using optical communications, so these references would have been considered by the skilled person to be only peripherally relevant to the problem addressed by the subject application.

Accordingly, the person skilled in the art would not have arrived directly and without difficulty, by routine steps, at the optical communications system of claims 1-20 of the subject application in light of the acoustic communications system of Schmidt *et al.* in view of Weid *et al.*, whether taken alone or in combination.

The claims of the subject application recite a communications system comprising a plurality of beacons positioned so that each beacon emits light in a plurality of directions, and at least one submersible craft comprising a plurality of light receiving elements positioned so that the craft receives light from a plurality of directions, such that "when the submersible craft *is in the communications zone* the submersible craft *is in optical communication* with at least one beacon *for receiving control data* from the at least one beacon *via light signals* emitted by the at least

one beacon", which in accordance with the above arguments distinguishes the present invention over the prior art cited.

Favourable reconsideration and allowance of this application are respectfully requested.

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